

**Astoria – East Boat Basin  
Breakwater  
Sediment Evaluation,  
Phase II  
(May 4, 1999 Sampling Event)**

**Abstract**

The Clean Water Act (CWA) of 1977, as amended regulates dredging activities and requires sediment quality evaluation, including testing, prior to dredging. Guidelines to implement 40 CFR Part 230-Section 404(b)(1) regulations of the CWA, the national (The Inland Testing Manual) (ITM) and the regional (Dredge Material Evaluation Framework for The Lower Columbia River Management Area Dredge Material Evaluation Framework) (DMEF) manuals have adopted a tiered testing approach for the evaluation of dredge material. The Tier IIa (physical testing) and Tier IIb (chemical testing) have been completed for this evaluation. The screening levels (SL) used are those listed in the regional manual.

The Corps of Engineers, Portland District personnel, collected 6 vibra-core samples and 5 surface grab samples on May 4, 1999. The samples were classified as, silty sand to silt. The mean grain size of all samples was 0.70mm. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), phenols and phthalates. A composite from four sampling stations (A-VC-03 through A-VC-06, located inside the boat basin, was analyzed for organotin (interstitial water method). All analyses except the organotin were below SLs. The organotin results exceeded the SL of 0.15 ug/L with a result of 0.748 ug/L. As a result, follow-up TBT analyses were run on all sediment samples collected. These follow-up analyses isolated the TBT, above the SL, to be outside the Phase II construction area (A-VC-03 sample). This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which did not exceed the SL and are located outside the Phase II construction area.

The Tier IIa (physical) and the Tier IIb (chemical) analyses run on the proposed dredge material from Phase II of this project are well below SLs and the dredge material is determined to be suitable for unconfined in-water disposal without further testing.

**Introduction**

The purpose of this report is to characterize the sediment of the Astoria East Boat Basin, based on the sampling events described. Reference will be made to the project Sampling and Analysis Plan (SAP) attached to this report and listed as a reference. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

## SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below.

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.
- Collect, handle and analyze representative sediment, surface and core samples, of the purposed dredging prism, and the newly exposed surface, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted, unless sediment analysis indicates the necessity for further testing.

### Historical Data

The Corps of Engineers, Portland District personnel took 5 core samples and 3 surface grab samples on April 27, 1998 within the Phase I dredge prism. The core samples taken were classified as, fine to very fine-grained sandy silt with color bands of dark gray to light gray and contained small amounts of organic material. The 2 longest cores (A-VC-02, 03) were divided into 2 (lower & upper) composite samples each. The other cores and surface samples were treated as individual samples. All samples were submitted to Sound Analytical Services, Inc. laboratory for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). Total DDT exceeded the SL (6.9 ug/kg) on one core, both top "A" and bottom "B" samples. The "A" sample is a composite from the surface to 48 inches in depth, with DDT detected at 9.69 ug/kg. The "B" sample represents the lower depth, from 48 inches down to the core depth of 130 inches, with DDT detection of 7.0 ug/kg. As a result of the DDT exceedance Tier III bioassay were collected on June 30, 1998. Three samples by gravity core and 1 box core sample were taken near the breakwater structure where DDT was detected in excess of the SL. These samples were submitted for bioassay analysis as well as ammonia, sulfide, TOC, total DDT, and physical analyses. DDT was not detected above the screening level in any of the samples collected. One sample (A-GC-02) was also submitted for PAHs when a petroleum sheen and odor were detected in the field sample. PAHs were detected in excess of the screening levels for some PAHs. A box core sample was taken further from the wall as a reference site for the bioassay analysis. The bioassay analysis indicated the material was not suitable for open water disposal. The dredge material was disposed of at an upland disposal facility.

## **Current Sampling Event Methods and Discussion**

On May 4, 1999 six vibra-core samples and 5 surface grab samples were collected. The samples were classified as silt to silty sand. The mean grain size of the samples was 0.70mm. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), phenols and phthalates. A composite from four sampling stations (A-VC-03 through A-VC-06, located inside the boat basin, was analyzed for organotin (interstitial water method). All analyses except the organotin were below SLs. The organotin results exceeded the SL of 0.15 ug/L with a result of 0.748 ug/L. As a result, follow-up TBT analyses were run on all sediment samples collected. These follow-up analyses isolated the TBT, above the SL, to be outside the Phase II construction area (A-VC-03 sample). This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which, did not exceed the SL and are located outside the Phase II construction area.

The Tier IIa (physical) and the Tier IIb (chemical) analyses run on the proposed dredge material from Phase II of this project are well below SLs and the dredge material is acceptable for unconfined in-water disposal without further testing.

Sampling and analysis were performed using proper quality control measures. Proper chain of custody, preservation (4°C.) and cooler receipt was carried out. The laboratory reported no quality control issues for the analytical procedures carried out on the sediment sampled in Astoria East Boat Basin for the May sampling event. The TBT result value that exceeded the SL was review to ensure that it met all QC criteria and the value is considered valid.

### **Methods for May 4, 1999 Sampling Event.**

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. All of the 12 samples submitted for physical analyses exceeded 20% fines and were submitted for chemical analysis. Only 1 of the 12 samples exceeded 5% volatile solids. Samples were classified as silt to silty sand. Median grain size for the samples is 0.70mm, with an average of 45.5 % sand and 46.8 % fines.

Metals, Total Organic Carbon (TOC): Data for these analyses are presented in Table 2. Eleven samples were submitted for analyses. All inorganic metals were less than the SLs. The highest level detected was Zinc at 34% of the screening level.

Organotin (Total TBT): Data for these analyses are presented in Table 3. Note: Initially only the composite sample was run. When the analyses showed that TBT exceeded the SL, all samples were run for TBT to isolate area-containing TBT. In all, 13 samples were submitted for TBT analyses. The SL (0.15 ug/L) was exceeded in the composite sample for TBT (0.748 ug/L) further analyses of all individual samples collected indicated TBT above the SL to be located in the A-VC-03 (0.34 ug/L) sample. This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which are located outside the Phase II construction area.

Pesticide/PCBs: All data results for both pesticides and polychlorinated biphenyls PCBs were non-detect at the method detection limit (MDL) and practical quantitation limit (PQL). The non-detect is noted as part of Table 4. The PQLs are well below the screening levels adopted for evaluation of dredge material in the DMEF.

Phenols, Phthalates, Chlorinated Organic Compounds and Extractables: Data for these compounds are presented in Table 4. (Only compounds that were detected are listed). All compounds listed were detected at low levels. The highest level detected of all these compounds is only 8% of the DMEF screening level (SL).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs are presented in Tables 5 & 6. Both low and high density PAHs were detected at low levels in all of the samples submitted on May 4<sup>th</sup>, but none approached the screening level (SL). The highest individual level of a PAH compound (acenaphthylene) detected was 64% of the SL. All other PAHs were less than 12% of the corresponding SL.

## **Conclusion**

As mentioned in the text six vibra-core samples and 5 surface grab samples were collected on May 4, 1999. The samples were classified as silt to silty sand. The mean grain size of the samples was 0.70mm. All samples were submitted for Tier IIa (physical) and the Tier IIb (chemical) analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). A composite from four sampling stations, A-VC-03 through A-VC-06, located inside the boat basin was analyzed for organotin (TBT) (interstitial pore water). Total TBT on the composite sample was 0.748ug/L. This value is in excess of the screening level (SL) of 0.15 ug/L stated in the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area. A follow-up TBT analyses on each of the sediment samples collected was conducted to determine where the high concentration TBT was. The individual TBT analyses indicated the TBT in excess of the SL to be located in sample A-VC-03. This sample is bracketed on each side by samples that are less than the SL and are outside the Phase II construction area. Further investigation of the area containing the TBT will be carried out in a future phase of construction. All other chemical analyses were below the screening levels. The sediment represented by the samples analyzed within the Phase II construction area is below DMEF screening levels and is acceptable for unconfined open water disposal.

## References

1. Percy, K.L., Bella, D.A., Sutterlin, C., Klingeman, P.C. 1974. Descriptions and information Sources for Oregon Estuaries. Sea Grant College Program, Oregon State University.
2. Navigation Branch, Operations Division, U. S. Army Corps of Engineers, Portland District. September 1991. Federal Navigation Projects: Columbia River Maintenance Disposal Plan. (Prepared by Mandaville Associates, 600 S. W. Tenth #418, Portland, Oregon 97205)
3. U.S. Army Corps of Engineers, Portland District, Seattle District, U.S. Environmental Protection Agency, Region 10, Oregon Department of Environmental Quality, Washington State Department of Natural Resources. April 1998 (draft document). Dredge Material Evaluation Framework for the Lower Columbia River Management Area.
4. U.S. Army Corps of Engineers, Portland District. 1987. Astoria Deep Draft Summary of Existing Data, Portland, Oregon.
5. Sherman, T.J. 1998. U.S. Army Corps of Engineers, Portland District. Astoria East Boat Basin Sediment Evaluation, Phase I.
6. Sherman, T.J. 1999. U.S. Army Corps of Engineers, Portland District. Astoria East Boat Basin Phase II, Sampling and Analysis Plan.

## Physical Analytical

	Grain Size (mm)				%					
Sample I.D.	Median		Mean		Gravel	Sand	Silt/Clay	Volatile solids		
A-VC-01A	0.043		0.0604		0.00	30.07	69.93		4.71	
A-VC-01B	0.055		0.0611		0.19	43.61	56.20		3.17	
A-VC -02A	0.085		0.1399		1.00	65.11	33.89		4.16	
A-VC -02B	0.43		1.8281		18.68	65.82	15.51		3.79	
A-VC -03	0.041		0.3850		5.33	29.81	64.86		3.80	
A-VC -04	0.042		0.0597		0.10	21.63	78.27		4.02	
A-VC -05	0.051		0.0592		0.00	32.73	67.27		2.33	
A-VC -06	0.050		0.0588		0.16	33.65	66.19		2.73	
A-PG-07	0.079		0.8085		9.50	44.99	45.50		5.09	
A-PG -08	0.32		0.8008		8.78	72.72	18.5		2.89	
A-PG -09	0.060		0.0648		0.00	53.62	46.38		4.37	
A-PG -10	0.14		1.0764		12.54	52.18	35.28		4.06	
A-PG -11	0.71		2.1153		25.02	42.34	32.65		4.32	
A-PG -11 (DUP)	2.0		2.3227		26.68	49.07	24.05		4.14	
Mean	0.293		0.7029		7.7129	45.52	46.75		3.83	
Minimum	0.041		0.0588		0.00	21.63	15.51		2.33	
Maximum	2.0		2.3227		26.68	72.72	69.93		5.09	

**Inorganic Metals and TOC**

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg									mg/kg
A-VC-01A	3.6	<83	<.17	27	<14	<.13	11	<0.052	140	10000
A-VC-01B	5.4	<62	0.36	27	<10	<.12	11	<0.039	110	10000
A-VC -02	2.2	<86	<.18	17	<11	<.13	9.1	<0.054	77	10000
A-VC -03	6.2	<92	<.19	37	<15	<.15	13	<0.058	120	16000
A-VC -04	3.8	<69	0.21	26	<11	<.12	14	<0.043	110	16000
A-VC -05	2.2	<65	<.13	35	<11	<.10	5.2	<0.041	64	5300
A-VC -06	4.4	<71	<.15	21	<12	0.12	12	<0.044	100	5900
A-PG-07	3.3	<90	<.19	26	<15	<.12	9.7	<0.057	98	13000
A-PG -08	3.6	<67	<.14	13	<11	<.10	7.4	<0.042	51	8900
A-PG -09	2.5	<84	<.18	25	<14	<.10	13	<0.053	88	12000
A-PG -10	3.9	<74	<.15	21	<12	<.10	11	<0.046	82	10000
A-PG -11	15	<80	<.17	30	<13	<.12	15	<0.051	91	11000
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410	
Mean	4.7	ND	0.16	25.4	ND	ND	11	ND	94.3	
Maximum	15	ND	1.8	37	ND	ND	15	ND	140	
Symbol (<) = Non-detect at the value listed (Method Detection Limit)										

# Organotin

Sample ID		Tetrabutyltin	Tributyltin	Dibutyltin	Monobutyltin		Total TBT
Ug/L (ppb)							
* Composite		<b>0.068</b>	<b>0.29</b>	<b>0.27</b>	<b>0.12</b>		<b>0.748</b>
A-VC-01A		<0.032	<0.024	<0.033	<0.03		ND
A-VC-01B		<0.047	<0.034	<0.048	<0.044		ND
A-VC -02		0.034	<0.024	<0.033	<0.03		0.034
A-VC -03		<b>0.086</b>	<b>0.25</b>	<0.053	<0.048		<b>0.336</b>
A-VC -04		<0.05	<0.036	<0.05	<0.046		ND
A-VC -05		<0.099	<0.072	<0.1	<0.092		ND
A-VC -06		<0.099	<0.072	<0.1	<0.092		ND
A-PG-07		<0.033	<0.024	<0.033	<0.031		ND
A-PG -08		<0.099	<0.072	<0.1	<0.092		ND
A-PG -09		<0.05	<0.036	<0.05	<0.046		ND
A-PG -10		<0.05	<0.036	<0.05	<0.046		ND
A-PG -11		<0.033	<0.024	<0.033	<0.031		ND
Screening level (SL)		+	+	+	+	=	0.15
TBT = Total organotin (interstitial water).							
* This sample is a composite of sample A-VC-03 through A-VC-06.							
Symbol (<) = Non-detect at the value listed (Method Detection Limit)							
Note: Initially only the composite sample was run. When the analyses showed that TBT exceeded the SL, all samples were run for TBT to isolate area-containing TBT.							



## Pesticides/PCBs, Phenols, Phthalates, Chlorinated Organic Compounds and Extractables

Sample I.D.	Phenols			Phthalates					Extractables		
ug/kg (ppb)											
	Phenol	Pentachloro phenol	3-&4-Methyl phenol	Dimethyl phthalate	bis(2-Ethylhexyl) phthalate	Butylbenzyl phthalate	Diethyl phthalate	Di-n-butyl phthalate	Benzoic Acid	Benzyl Alcohol	Dibenzofuran
A-VC-01A	7.1	35	80	4.3	27	7.7	<14	12	<15	<14	<13
A-VC-01B	5.8	17	85	<13	38	<13	<14	9.7	<15	<14	6.9
A-VC -02	<12	<15	28	<13	<14	<13	5.3	14	<15	<14	4.4
A-VC -03	<12	51	46	<13	28	<13	8.9	5.9	<15	6.6	<14
A-VC -04	5.8	11	17	4.6	32	6.4	32	7.1	<15	<14	<14
A-VC -05	<12	<15	18	<13	18	<13	<14	7.7	<15	<14	<14
A-VC -06	<12	<15	<15	<13	11	<13	<14	6.2	<15	<14	<14
A-PG-07	23	27	53	3.1	35	5.5	<14	10	25	<14	<14
A-PG -08	<12	<15	17	<13	30	<13	<14	8.1	<15	<14	<14
A-PG -09	<12	<15	<15	<13	27	<13	<14	9.4	<15	<14	<14
A-PG -10	14	<15	220	3.1	19	<13	<14	7.9	<15	<14	<14
A-PG -11	34	<15	230	<13	18	<13	<14	<15	<15	<14	<14
Screening level (SL)	420	400	670	1400	8300	1200	970	8300	650	650	540
Mean	8	12	66	1.3	24	2	3.9	8	2	0.6	1
Maximum	34	51	230	4.6	38	7.7	32	14	25	6.6	6.9

PCBs = Non-detect <18.0 ppb (SL = 130 ppb)

Pesticides = Non-detect <0.33 to <2.4 ppb (SL = 10 ppb for all pesticides, except Total DDT = 6.9ppb)

Symbol (<) = Non-detect at the value listed (Method Detection Limit)

**Polynuclear Aromatic Hydrocarbons (PAHs)****Low Molecular Weight Analytes****ug/kg (ppb)**

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Total Low PAHs
A-VC-01A	<2.5	11	7.1	4.9	<2.8	6.2	27	56.2
A-VC-01B	<2.5	23	14	11	3.8	9.9	99	159.7
A-VC -02	8.1	360	66	30	4.4	5.6	28	502.1
A-VC -03	<3.1	13	10	7.2	16	5.3	46	97.5
A-VC -04	<3.1	5.8	6.1	2.5	<3.1	4.3	19	35.2
A-VC -05	<3.1	6.2	6.9	5.2	<2.4	8.7	39	66
A-VC -06	9.3	21	24	13	4.3	6.2	100	177.8
A-PG-07	<3.1	<3.1	4	<2.5	<3.1	<3.1	14	18
A-PG -08	<2.5	5.8	3.8	3.3	3.3	<2.5	64	80.2
A-PG -09	4.9	5.7	27	8.3	3.1	6.3	60	115.3
A-PG -10	<3.1	8.2	7.6	<2.5	<3.1	<3.1	27	42.8
A-PG -11	<3.1	<3.1	<2.9	<2.5	<3.1	<3.1	8	8
Screening level	500	560	960	540	670	2100	1500	5200
Mean	1.9	38.3	14.7	7.2	2.9	4.4	44.3	121.6
Maximum	9.3	360	66	30	16	9.9	100	502
Symbol (<) = Non-detect at the value listed (Method Detection Limit)								

# Polynuclear Aromatic Hydrocarbons (PAHs)

## High Molecular Weight Analytes

ug/kg (ppb)

Sample I.D.	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Pyrene	Benzo(a)pyrene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Fluoranthene	Total High PAHs
A-VC-01A	24	56	11	39	32	65	36	<3.1	33	69	365
A-VC-01B	53	100	30	51	75	140	85	7.6	52	190	840
A-VC -02	160	64	20	23	170	260	130	<2.8	<2.8	120	947
A-VC -03	24	52	22	20	45	76	27	<3.3	28	130	424
A-VC -04	22	42	9	28	31	39	25	<2.5	23	41	260
A-VC -05	22	37	11	22	35	79	31	<2.5	23	88	346
A-VC -06	41	67	23	47	49	120	72	6	46	140	979
A-PG-07	11	25	4.9	13	15	29	11	<3.1	<3.1	19	128
A-PG -08	17	36	6	19	31	73	21	<2.5	14	48	255
A-PG -09	31	33	8	15	45	97	26	<2.9	20	68	343
A-PG -10	26	26	10	20	29	58	36	<2.8	15	44	264
A-PG -11	6.6	11	5.4	3.4	8	12	11	<2.9	6.6	13	77
Screening level	1300	3200		670	1400	2600	1600	230	600	1700	12000
Mean	36.5	30		25	47	87	43	1	22	81	436
Maximum	160	130		51	170	260	130	7.6	52	190	947
<p>Symbol (&lt;) = Non-detect at the value listed (Method Detection Limit)</p>											

Figure 1

## Port of Astoria, East Boat Basin, Phase II

